MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2016/2017

HCB1011 – CELL BIOLOGY

(All sections / Groups)

20 OCTOBER 2016
2.30 p.m. – 4.30 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of **7** pages with **5** Questions only.
2. Answer **ALL THE QUESTIONS**. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please print all your answers **clearly** and **neatly** in the space provided.

Question 1

a) Why do cells generally have to be small in size? What will the cell do in response to an increase in size? [2 marks]

b) Briefly, describe the "Primordial soup model" of life formation. [2 marks]

c) Name the structure/organelle that provides the following functions: [3 marks]

i. Controls what passes in and out of the cell :

ii. Network of protein filaments that provides structural support :

iii. Packages proteins for export from the cell :

iv. Digests worn-out organelles and cell debris :

v. Organelle that produces most of the cell energy :

vi. Site of protein synthesis :

d) If you poke a hole in a mitochondrion, can it still perform oxidative respiration? Explain your answer. [2 marks]

e) An ancient plant called horsetail contains 216 chromosomes. How many homologous pairs of chromosomes does it contain? How many chromosomes are present in its cells during metaphase? [1 mark]

Continued...

Question 2

a) Suppose you are provided with an actively dividing culture of *E. coli* bacteria to which radioactive thymine has been added. If a cell replicates once in the presence of this radioactive base, will both the daughter cells be radioactive? Why? [2 marks]

b) For a science fair project, two students decided to repeat the Hershey and Chase experiment, with modifications. They decided to label the nitrogen of the DNA, rather than the phosphate. They reasoned that each nucleotide has only one phosphate and two to five nitrogens. Thus, labeling the nitrogens would provide a stronger signal than labeling the phosphates. Why won't this experiment work? [1 mark]

c) How is replication in eukaryotes different from that in prokaryotes? Name at least TWO differences. [2 marks]

d) What is the function of RNA primers in DNA replication? What enzyme makes the RNA primer? [1 mark]

Continued...

e) What is the function of helicase in the replication complex? What is the function of the single strand binding (SSB) protein? [1 mark]

f) Describe the "proof-reading" activity of DNA polymerase III in *E. coli*. [2 marks]

g) Why is DNA repair at the time of replication an important process in cells? [1 mark]

Continued...

Question 3

a) Name and briefly describe the three stages of transcription. [3 marks]

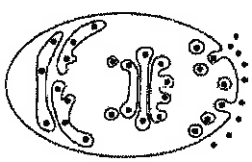
b) What are the purposes of the 5' and 3' modification of eukaryotic mRNA? [1 mark]

c) Why is the genetic code referred to as degenerate? [1 mark]

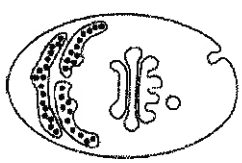
d) What could happen to a protein in the secretory pathway? Name at least TWO events. [1 mark]

e) What is the role of chaperon proteins? [1 mark]

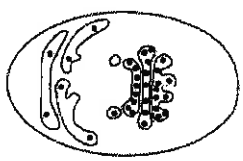
f) Three of the eukaryotic cells (Cell A, B, and C) shown below are defective with respective to the protein secretory pathway. Name the defect in each of these three cells. The wild-type control is shown in the figure. [3 marks]



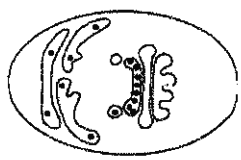
Wild type



Cell A



Cell B



Cell C

Cell A :

Cell B :

Cell C :

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Question 4

a) The extracellular matrix (ECM) is the non-cellular component present within all tissues and play important roles in regulating a cell's dynamic behavior. List at least FOUR functions of ECM. [2 marks]

b) At first glance, the signaling systems that involve cell surface receptors may appear rather complex and indirect, with their use of G proteins, second messengers, and often multiple stages of enzymes. What are the advantages of such seemingly complex response systems? [4 marks]

c) Cells communicate through different mechanisms, depending primarily on the distance between the signaling and the responding cells. Name and describe the FOUR basic mechanisms of cell signaling. [4 marks]

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Question 5

a) Draw a diagram to illustrate the phases and checkpoints in the cell cycle. Describe what happens in each of the checkpoints. [5 marks]

b) When a cell becomes cancerous, it develops traits that normal cells do not have. Name at least FOUR differences between cancer cells and normal cells. [2 marks]

c) Define totipotent, pluripotent, and multipotent stem cells. Give one example of each cell type. [3 marks]

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